# 2-WIRE DIAL PULSE TERMINATING (DPT9 AND DPT6) CHANNEL UNIT, 628160

## GENERAL DESCRIPTION

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### 1. GENERAL

**1.01** This Section provides a general description of the ITT D448 2-wire dial pulse terminating (DPT9 and DPT6) channel unit, 628160 (Fig. 1), to the functional block diagram level.

**1.02** This Section has been reissued to include information on the handling of CMOS-equipped units.

**1.03** The unit provides a voice frequency (VF) and signaling interface between the central office (C.O.) equipment and the D448 multiplex terminal common equipment. In the transmit direction, the unit converts VF and signaling information into pulse code modulation (PCM) for application to the common equipment. In the receive direction, the unit decodes received PCM into VF and signaling information. During system outages, the unit provides various disconnect/make-busy routines for the trunk. The unit provides the terminating end of a 900- or 600-ohm, 2-wire reverse battery loop signaling message circuit.

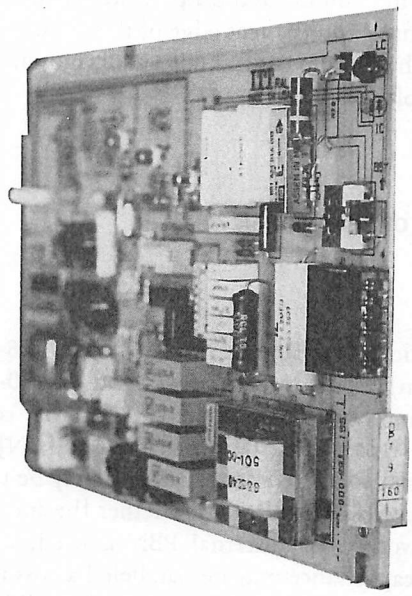


**Fig. 1—DPT Channel Unit, 628160**

### 2. DESCRIPTION

**2.01** The unit mounts in the D448 multiplex shelf (channel unit mounting section) in connectors J1A through J24A (for Digroup A) or connectors J1B through J24B (for Digroup B). Installation procedures for the unit are provided in Section ITTR-18-440.

**2.02** The unit is available in two groups. Group -0 provides 900-ohm plus 2.16-uF impedance matching. Group -1 provides 600-ohm plus 2.16-uF impedance matching. Group -0 is designated by the mnemonic DPT9. Group -1 is designated by the mnemonic DPT6.

**2.03** The unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The lower front edge of the PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf. An identification strip on the handle face indicates the unit mnemonic (DPT9 or DPT6), last three digits of the model number, last three digits of the part number, and issue letter. The part number and issue letter are also located on the component side of the PCB.

2.04 The LC LED (DS1), the BSY switch (S5), and the splitting card jack (J1) are located on the front edge of the PCB.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 60-pin contact edge connector on the rear of the multiplex shelf.

## 3. FUNCTIONAL OPERATION (FIG. 2)

### HYBRID

3.01 The hybrid is toll-grade and provides 28-dB (minimum) echo return loss and a 20-dB (minimum) singing return loss. Either the internal compromise network (by selecting DIP switch option [CN]) or an external precision balance network (PBN) may be used to balance the hybrid. Regardless of whether the internal compromise network or an external PBN is used, additional build-out capacitance may be paralleled across it by selecting DIP switch options [2] through [64]. Build-out capacitance from 0.002 to 0.126 uF in 0.002-uF steps may be selected. The NT and NR leads are brought out for connection to an external PBN. If an external PBN is used, the [CN] DIP switch should be opened (not selected).

### TRANSMIT VF CIRCUIT

3.02 The incoming VF is transformer-coupled to the low-pass/high-pass filter where it is amplified and filtered. The gain applied to the input signal can be varied over a 3-dB range to compensate for VF input levels from 0 to $-3.0$ dBm (in 1-dB steps) by the selection of transmit (TX) prescription level DIP switch options [$-1$], [$-2$], or [$-3$]. The resulting signal is passed to the TX office wiring loss (OWL) compensation circuit. The TX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal applied to the encoder to compensate for office wiring/cabling losses. The resultant range for input levels is 0 to $-4.5$ dBm in 0.1-dB steps.

3.03 The encoder converts the VF signal and signaling information (Para. 3.06 and 3.07) to an 8-bit PCM word. When the TX AND gate is activated by the transmit logic unit (TLU) on the TCS4-X and TCS6-X leads, the 8-bit word is applied to the TLU via the TCD bus. The data is clocked out of the unit under control of the 1.536-MHz clock from the TLU.

### RECEIVE VF CIRCUIT

3.04 An 8-bit PCM word from the receive logic unit (RLU) is applied to the decoder on the RCD bus. The decoder will only accept the data when the receive (RX) AND gate is activated by the RLU on the RCS4-X and RCS6-X leads. The decoder converts the PCM word into a VF signal and signaling information (Para. 3.08 and 3.09).

3.05 The VF signal is applied to the low-pass filter and passed through to the RX OWL compensation circuit. The RX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal out of the low-pass filter to compensate for office wiring/cabling losses. The output of this circuit is further amplified. This amplification can be varied over a 6-dB range (in 1-dB increments) by the selection of RX prescription VF level DIP switch options [$-1$] through [$-6$]. This provides output levels of $+1.5$ to $-6.0$ dBm in 0.1-dB increments with both the OWL and prescription VF level options. The amplified VF is transformer-coupled to the C.O. equipment.

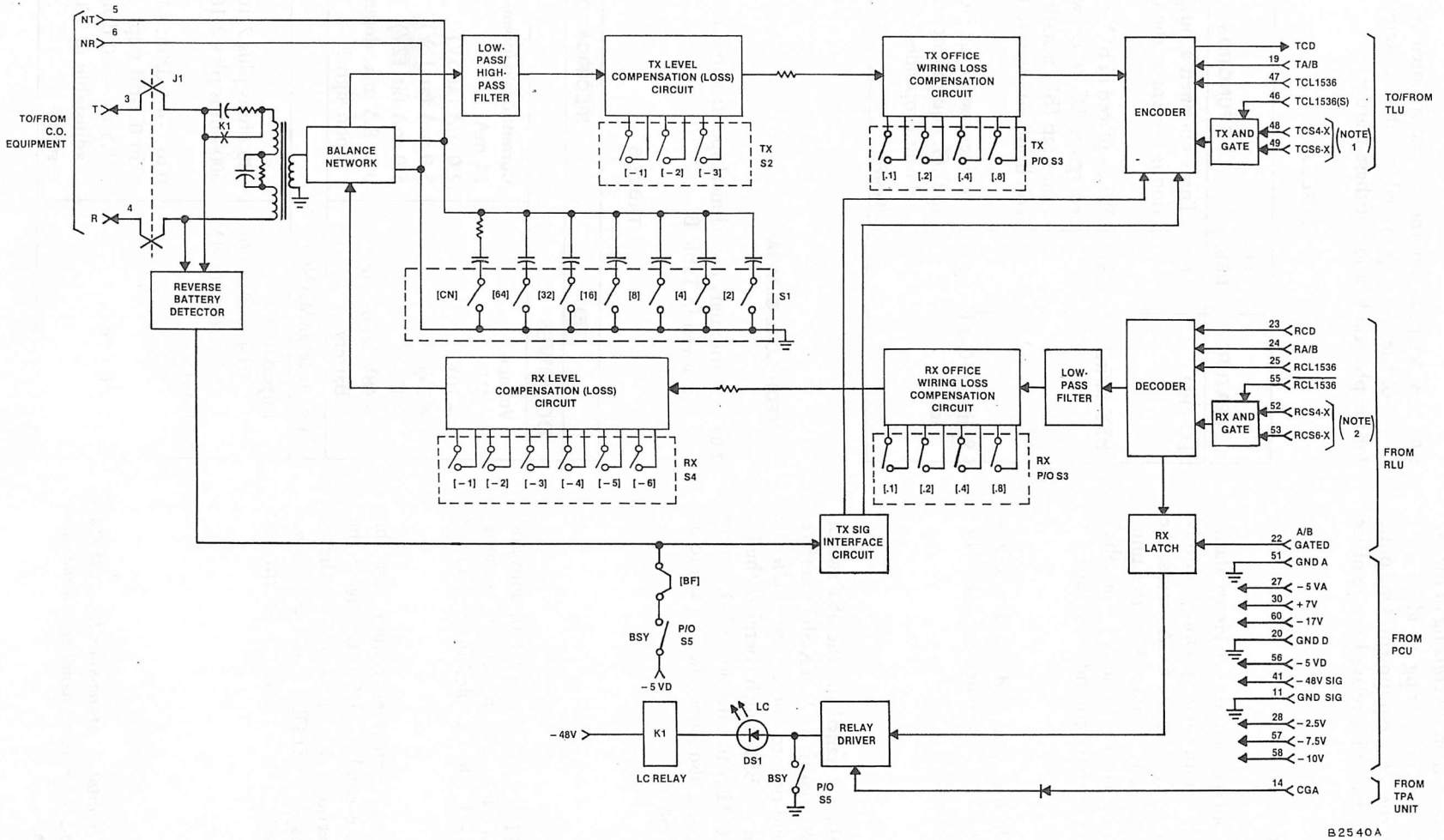
### TRANSMIT SIGNALING

3.06 An idle condition at the 2-wire drop is represented by normal battery polarity (tip-positive, ring-negative) or by an open. A busy condition at the 2-wire drop is represented by reverse battery (tip-negative, ring-positive). The reverse battery detector detects these conditions and signals the TX signaling (SIG) interface circuit as to the status of the 2-wire drop. During an idle condition, the TX SIG interface circuit applies a digital zero to the encoder. During a busy condition, the TX SIG interface circuit applies a digital one to the encoder. The encoder will not process the information supplied to it until it is signaled on the TA/B lead by the TLU that the signaling frame is upcoming.

3.07 The reverse battery detector provides 11 milliseconds of delay before signaling the TX SIG interface circuit that a change in polarity has occurred. This guards against false operation from detecting transients, such as those due to dial pulsing and opening of the T and R leads.

### RECEIVE SIGNALING

3.08 The decoder converts receive signaling information from the 8-bit PCM word when it is signaled by the RLU on the RA/B lead that the signaling frame is being processed by the terminal. The decoded signaling information is applied to the RX latch.




NOTE:
1. MAY BE TCS4-A, B, C, OR D AND TCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.
2. MAY BE RCS4-A, B, C, OR D AND RCS6-A, B, C, D, E, OR F DEPENDING ON POSITION.
3. PROVIDED ON 628170-000-002 OR 628170-000-102 UNITS ONLY.

**Fig. 2—DPT Channel Unit, 628160, Functional Block Diagram**

3.09 During a busy condition, the LC relay is energized and the LC LED is turned on. Energizing of the LC relay seizes the office equipment. During an idle condition, the LC relay releases the office equipment. Dial pulse information sent from the far end is relayed to the office equipment by this relay.

### CARRIER GROUP ALARM

3.10 During a system outage, one carrier group alarm (CGA) signal (CGA immediate ground) controls the CGA functions of the unit. When a CGA occurs, the CGA lead provides an immediate ground to the unit. Strapping options on the backplane of the multiplex shelf control when the CGA immediate ground occurs after an alarm signal is received.

3.11 When the CGA lead is grounded, the LC LED is turned off and the LC relay is deenergized. This forces the loop to the office to go open.

### BUSY MODE

3.12 If option strap [BF] is installed and the BSY switch is placed in the BSY position, the TX SIG interface circuit sends a busy condition to the far end. On the receive side, operation of the BSY switch energizes the LC relay. This causes the LC LED to turn on and the office equipment to be seized, and also allows the VF path to be completed for test purposes.

## 4. OPTIONS

4.01 The unit is equipped with DIP switch options and strapping options for selecting circuit options. Refer to Section ITTR-18-440 for detailed information on option selection.

4.02 The multiplex shelf provides options on the backplane which control the CGA timing of the terminal. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

## 5. RESTRICTIONS

***WARNING: This unit contains static-sensitive (CMOS) devices. Section ITTR-18-599 contains handling instructions for CMOS-equipped units.***

## 6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table A. Refer to Fig. 1 for the physical location of these features.

**TABLE A**

| FEATURE | REF. DES. | FUNCTION |
|---|---|---|
| LC LED | DS1 | Turns on when a busy condition is present at the far end. |
| BSY Switch | S5 | When placed in BSY position, energizes LC relay; with option strap [BF] installed, busy condition also sent to far end. |
| Splitting Card Jack | J1 | Provides test/break jack access to C.O. equipment and channel unit drop sides of T and R leads. |

## 7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table B.

**TABLE B**

| ITEM | SPECIFICATION |
|---|---|
| DC POWER | |
| **Voltage** | **Current Drain (nominal)** |
| −5V | 24 mA |
| −10V | 2.0 mA (at 5V) |
| +7V | 5.0 mA (at 12V) |
| −17V | 5.0 mA (at 12V) |
| −48V Signaling Battery | 0 to 8.5 mA, depending upon signal conditions |
| VF PERFORMANCE | |
| Impedance | |
| DPT9 (628160-0) | 900 ohms plus 2.16 uF |
| DPT6 (628160-1) | 600 ohms plus 2.16 uF |
| Levels | |
| Transmit | 0 to −4.5 dBm, adjustable in 0.1-dB steps |
| Receive | +1.5 to −6.0 dBm, adjustable in 0.1-dB steps |

TABLE B (CONT)

| ITEM | SPECIFICATION |
|---|---|
| Loss Stability (End-to-End) | ± 0.5 dB over life in 95% of the circuits |
| Tracking (End-to-End) | |
| − 37 to + 3 dBm0 Input | 0.5 dB maximum deviation |
| − 50 to − 37 dBm0 Input | 1.0 dB maximum deviation |
| Idle Channel Noise (End-to-End) | 23 dBrnc0 maximum |
| Signal-to-Distortion | |
| 0 to − 30 dBm0 Input | 33 dB minimum overall; 35 dB minimum receive or transmit |
| − 40 dBm0 Input | 27 dB minimum overall; 29 dB minimum receive or transmit |
| − 45 dBm0 Input | 22 dB minimum overall; 25 dB minimum receive or transmit |
| Single Frequency Distortion (at 0 dBm0) | |
| Input Swept from 0 to 12 kHz | − 28 dBm0 maximum at any other frequency |
| Input between 1004 and 1020 Hz | − 40 dBm0 or less at any other frequency of 0 to 4 kHz with a distortion contribution objective from either transmit or receive of typically 6 dB better |
| Transhybrid Loss | |
| 200 to 500 Hz | 20 dB |
| 500 to 1000 Hz | 30 dB for DPT9, 28 dB for DPT6 |
| 1000 to 2500 Hz | 35 dB for DPT9, 30 dB for DPT6 |
| 2500 to 3400 Hz | 30 dB for DPT9, 28 dB for DPT6 |
| Echo Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit) | 28 dB minimum |

TABLE B (CONT)

| ITEM | SPECIFICATION |
|---|---|
| Singing Return Loss (Measured against nominal impedance with 25 ohms in series with channel unit and no far-end channel unit) | 20 dB minimum |
| Frequency Response (DPT9) (Referenced to 1020 Hz, End-to-End) | |
| 60 Hz | 20.0 dB minimum loss |
| 200 Hz | 0 to − 5.0 dB |
| 300 to 3000 Hz | + 0.5 to − 1.0 dB |
| 3200 Hz | + 0.4 to − 1.5 dB |
| 3400 Hz | 0 to − 3.0 dB |
| Frequency Response (DPT6) (Referenced to 1000 Hz at 0 dBm0, End-to-End) | |
| 600 to 2400 Hz | ± 1.0 dB |
| 300 to 3400 Hz | + 1.0 to − 3.0 dB |
| Balance Network | Compromise network of 900 or 600 ohms + 2.16 uF built-in and with BOC in 0.002-uF steps to 0.126 uF (NT and NR brought out for connection to external precision balance network) |
| Delay Distortion (End-to-End) | 94 PAR (minimum) |
| Longitudinal Balance (AT&T Method) | |
| 200 Hz | 66 dB minimum |
| 1000 Hz | 60 dB minimum |
| 3000 Hz | 58 dB minimum |
| Longitudinal Balance (IEEE Method) | |
| 200 Hz | 60 dB minimum |
| 1000 Hz | 60 dB minimum |
| 3000 Hz | 58 dB minimum |

TABLE B (CONT)

| ITEM | SPECIFICATION |
|---|---|
| SIGNALING | |
| DPO/DPT Channel Units<br>Pulsing Distortion | |
| Input (at DPO) | 150/150 ohm battery-ground pulsing at 12 pps, 73% break over 600-ohm VF extension to the channel unit |
| Output (at DPT) | 71% break maximum |
| Input (at DPO) | 150/150 ohm battery-ground pulsing at 12 pps, 49% break over 0-ohm loop |
| Output (at DPT) | 37% break minimum |
| Input (at DPO) | Loop pulsing at 12 pps, 68% break, with 2 uF and 600 ohms across pulsing contact, over 600-ohm VF extension to the channel unit |
| Output (at DPT) | 66% break maximum |
| Input (at DPO) | Loop pulsing at 12 pps, 58% break, with 2 uF and 600 ohms across pulsing contact, with no VF extension to the channel unit |
| Output (at DPT) | 45% break minimum |
| SDPO/DPT Channel Units<br>Pulsing Distortion | |
| Input (at SDPO) | Loop pulsing at 12 pps, 64% break with 1500 ohms external loop resistance |
| Output (at DPT) | 65% break maximum |

TABLE B (CONT)

| ITEM | SPECIFICATION |
|---|---|
| Input (at SDPO) | Loop pulsing at 12 pps, 58% break, 4 C4A ringers and 15K ohms leak resistance |
| Output (at DPT) | 40% break minimum |
| Input (at SDPO) | 150/150-ohm battery-ground pulsing at 12 pps, 73% break over 2000-ohm loop conductors |
| Output (at DPT) | 74% break maximum |
| Input (at SDPO) | 150/150-ohm battery-ground pulsing at 12 pps, 49% break over 0-ohm loop |
| Output (at DPT) | 39% break minimum |
| OPERATING ENVIRONMENT | |
| Temperature | 0 to +55°C |
| Humidity | To 95% at 40°C (no condensation) |
| Altitude | To 14,000 ft (4,300 m) |
| DIMENSIONS | |
| Width | 0.8 in. (1.9 cm) |
| Height | 5.9 in. (15.0 cm) |
| Depth | 9.7 in. (24.6 cm) |
| WEIGHT | 1.0 lb (0.5 kg) |

## 8. REPLACEABLE PARTS

**8.01** This unit has no field-replaceable parts.

## 9. REFERENCES

**9.01** The engineering drawings noted in Table C were used in the preparation of this Section.

TABLE C

| TYPE | DRAWING NO. |
|---|---|
| Assembly | 628160-000 |
| Schematic | 628160-002 |

**9.02** Related information on the DPT channel unit may be found in the ITTR Sections referenced in Table D.

**TABLE D**

| TITLE | SECTION NO. |
|---|---|
| Connectorized Multiplex Shelf (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest | ITTR-18-405 |
| Connectorized Multiplex Shelf (MS19/WC7, MS19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest | ITTR-18-406 |
| Trunk Channel Units — Option Selection and Installation | ITTR-18-440 |